# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**Patent Application**

Applicant(s): M.A.K. Alicherry et al.
Case: 7-7-6-22
Serial No.: 10/656,497
Filing Date: September 5, 2003
Group: 2619
Examiner: Man U Phan

Title: Routing and Design in K-Shared Networks

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## APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Sir:

Applicants (hereinafter referred to as "Appellants") hereby appeal the rejections of claims 1-5, 11-21, and 27-32 of the above referenced application.

The present application should be permitted to proceed to the Board for a decision on the merits.

## REAL PARTY IN INTEREST

The present application is assigned of record to Lucent Technologies Inc., as evidenced by an assignment recorded January 20, 2004 in the U.S. Patent and Trademark Office at Reel 014899, Frame 0573. On November 30, 2006, the assignee Lucent Technologies Inc. completed a merger with Alcatel S.A., with the resulting entity being named Alcatel-Lucent. Alcatel-Lucent is the real party in interest.

## RELATED APPEALS AND INTERFERENCES

There are no known related appeals and interferences.

## STATUS OF CLAIMS

The present application was filed on September 5, 2003 with claims 1-32.

Claims 6-10 and 22-26 have been allowed.

Claims 1, 16, 17, and 32 are the pending independent claims.

Claims 16 and 32 stand rejected under 35 U.S.C. §101.

Claims 16 and 32 stand rejected under 35 U.S.C. §112, first paragraph.

Claims 1-5, 11-15, 17-21, and 27-31 stand rejected under 35 U.S.C. §103(a).

Claims 1-5, 11-21, and 27-32 are appealed.

## STATUS OF AMENDMENTS

There has been no amendment filed subsequent to the final rejection.

## SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 recites a method of determining a route for a demand in a network, wherein the network comprises primary paths and secondary paths, and at least two secondary paths may share a given link. The method comprises the step of transforming a graph representing the network. Edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network. The transformation is performed such that costs associated with the edges reflect costs of using channels in secondary paths. The shortest path between nodes corresponding to the demand in the transformed graph is found. The shortest path representing the least-cost path in the network over which the demand may be routed.

An illustrative embodiment of a method of determining a route for a demand in a network, wherein the network comprises primary paths and secondary paths, and at least two secondary paths may share a given link, is described in the specification at, for example, page 7, lines 17-21, with reference to FIG. 2A; and FIG. 1A (illustrating a network with primary paths and secondary paths, and at least two secondary paths may share a given link). A graph representing the network is transformed (e.g., Specification, pg. 7, ln. 22, to pg. 8, ln. 5, with reference to FIG. 2B). Edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network

(e.g., Specification, pg. 8, lns. 9-17, with reference to FIGs. 3A and 3B). The transformation is performed such that costs associated with the edges reflect costs of using channels in secondary paths (e.g., Specification, pg. 7, lns. 19-20). The shortest path between nodes corresponding to the demand in the transformed graph is found (e.g., Specification, pg. 7, lns. 20-21; and Specification, pg. 7, lns. 5-6). The shortest path representing the least-cost path in the network over which the demand may be routed (e.g., Specification, pg. 7, lns. 20-21; and Specification, pg. 7, ln. 25, to pg. 8, ln. 7).

Independent claim 16 recites a method of designing a K-shared network based on a set of one or more demands. The method comprises the step of computing candidate primary paths and candidate secondary paths based on the set of one or more demands. At least two candidate secondary paths may share a given channel and the number of shared channels incident on another channel is a finite number K. An integer linear program formulation is applied to the computed candidate primary paths and candidate secondary paths. The integer linear program formulation applied to the computed candidate primary paths and candidate secondary paths is solved so as to generate a K-shared network design.

An illustrative embodiment of a method of designing a K-shared network based on a set of one or more demands is described in the specification at, for example, page 9, line 27, to page 12, line 4, with reference to FIG. 6. Candidate primary paths and candidate secondary paths based on the set of one or more demands are computed (e.g., Specification, pg. 10, lns. 5-9; and FIG. 6, step 602). At least two candidate secondary paths may share a given channel (see, e.g., Specification, pg. 5, lns. 25-26, with reference to FIGs. 1A and 1B, "The backup channels *l*1, *l*2 from the two backup paths are incident on node *N*6 and merge onto a single backup channel *L*.") and the number of shared channels incident on another channel is a finite number K (see, e.g., Specification, pg. 6, ln. 14, "The maximum degree allowed in a given network is in fact the K in K-sharing."). An integer linear program formulation is applied to the computed candidate primary paths and candidate secondary paths (e.g., Specification, pg. 10, ln. 9, to pg. 11, ln. 10; and FIG. 6, step 604). The integer linear program formulation applied to the computed candidate primary paths and candidate secondary paths is solved so as to generate a K-shared network design (e.g., Specification, pg. 12, lns. 1-4).

Independent claim 17 recites an apparatus for determining a route for a demand in a network, wherein the network comprises primary paths and secondary paths, and at least two secondary paths

may share a given link. The apparatus comprises a memory and at least one processor coupled to the memory. The at least one processor is operative to: (i) transform a graph representing the network, wherein edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network, the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths; and (ii) find the shortest path between nodes corresponding to the demand in the transformed graph, the shortest path representing the least-cost path in the network over which the demand may be routed.

An illustrative embodiment of an apparatus for determining a route for a demand in a network, wherein the network comprises primary paths and secondary paths, and at least two secondary paths may share a given link, is described in the specification at, for example, page 7, lines 17-21, with reference to FIG. 2A; and FIG. 1A (illustrating a network with primary paths and secondary paths, and at least two secondary paths may share a given link). The apparatus comprises a memory (e.g., Specification, pg. 12, lns. 18-21; FIG. 7, block 704; and Specification, pg. 12, ln. 27, to pg. 13, ln. 2) and at least one processor coupled to the memory (e.g., Specification, pg. 12, lns. 18-26; and FIG. 7, block 702). The at least one processor is operative to: (i) transform a graph representing the network (e.g., Specification, pg. 7, ln. 22, to pg. 8, ln. 5, with reference to FIG. 2B), wherein edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network (e.g., Specification, pg. 8, lns. 9-17, with reference to FIGs. 3A and 3B), the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths (e.g., Specification, pg. 7, lns. 19-20); and (ii) find the shortest path between nodes corresponding to the demand in the transformed graph (e.g., Specification, pg. 7, lns. 20-21; and Specification, pg. 7, lns. 5-6), the shortest path representing the least-cost path in the network over which the demand may be routed (e.g., Specification, pg. 7, lns. 20-21; and Specification, pg. 7, ln. 25, to pg. 8, ln. 7).

Independent claim 32 recites an apparatus for designing a K-shared network based on a set of one or more demands. The apparatus comprises a memory and at least one processor coupled to the memory. The at least one processor is operative to: (i) compute candidate primary paths and candidate secondary paths based on the set of one or more demands, wherein at least two candidate secondary paths may share a given channel and the number of shared channels incident on another

channel is a finite number K; (ii) apply an integer linear program formulation to the computed candidate primary paths and candidate secondary paths; and (iii) solve the integer linear program formulation applied to the computed candidate primary paths and candidate secondary paths so as to generate a K-shared network design.

An illustrative embodiment an apparatus for designing a K-shared network based on a set of one or more demands is described in the specification at, for example, page 9, line 27, to page 12, line 4, with reference to FIG. 6. The apparatus comprises a memory (e.g., Specification, pg. 12, lns. 18-21; FIG. 7, block 704; and Specification, pg. 12, ln. 27, to pg. 13, ln. 2) and at least one processor coupled to the memory (e.g., Specification, pg. 12, lns. 18-26; and FIG. 7, block 702). The at least one processor is operative to: (i) compute candidate primary paths and candidate secondary paths based on the set of one or more demands (e.g., Specification, pg. 10, lns. 5-9; and FIG. 6, step 602), wherein at least two candidate secondary paths may share a given channel (see, e.g., Specification, pg. 5, lns. 25-26, with reference to FIGs. 1A and 1B, "The backup channels *l*1, *l*2 from the two backup paths are incident on node *N*6 and merge onto a single backup channel *L*.") and the number of shared channels incident on another channel is a finite number K (see, e.g., Specification, pg. 6, ln. 14, "The maximum degree allowed in a given network is in fact the K in K-sharing."); (ii) apply an integer linear program formulation to the computed candidate primary paths and candidate secondary paths (e.g., Specification, pg. 10, ln. 9, to pg. 11, ln. 10; and FIG. 6, step 604); and (iii) solve the integer linear program formulation applied to the computed candidate primary paths and candidate secondary paths so as to generate a K-shared network design (e.g., Specification, pg. 12, lns. 1-4).

## GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

I. Claims 16 and 32 stand rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter.

II. Claims 16 and 32 stand rejected under 35 U.S.C. §112, first paragraph.

III. Claims 1-5, 11-15, 17-21, and 27-31 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 7,023,806 to Gunluk (hereinafter "Gunluk") in view of U.S. Patent No. 7,058,012 to Chen et al. (hereinafter "Chen").

## ARGUMENT

Appellants incorporate by reference herein the disclosures of all previous responses filed in the present application, namely, responses dated September 18, 2007 and March 7, 2008. Sections I, ll, and lll to follow will respectively address grounds I, II, and III presented above.

### *I. Non-Statutory Subject Matter of Claims 16 and 32*

Regarding the §101 rejection of claims 16 and 32, Appellants respectfully reassert that claims 16 and 32 recite patentable subject matter for at least the reasons presented in Appellants' previous responses, as well as the reasons presented below.

Independent claims 16 and 32 recite patentable subject matter under §101. An algorithm-containing invention is patentable if the invention, as a whole, produces a "useful, concrete, and tangible result," and regardless of the fact that parts of the invention fall within the judicial exceptions of patentable subject matter. AT&T Corp. v. Excel Comm. Inc., 50 U.S.P.Q.2d 1447, 1454 (1999); State Street Bank & Trust Co. v. Signature Financial Group Inc., 49 U.S.P.Q.2d 1596, 1601 (1998); In re Alappat, 31 U.S.P.Q.2d 1545, 1557 (1994). Under 35 U.S.C. §101, "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." 35 U.S.C. §101. The judicial exceptions to patentable subject matter include "laws of nature, physical phenomena, and abstract ideas." Diamond v. Chakrabarty, 206 U.S.P.Q.2d193, 197 (1980). However, the Federal Circuit has held that an invention is not an unpatentable abstract idea, if the invention produces a "useful, concrete, and tangible result." In re Alappat, 31 U.S.P.Q.2d at 1557; see State Street, 49 U.S.P.Q.2d at 1601. "The dispositive inquiry is whether the claim as a whole is directed to statutory subject matter, it is irrelevant that a claim may contain, as part of the whole, subject matter which would not be patentable by itself." ln re Alappat, 31 U.S.P.Q. at 1557.

Appellants respectfully submit that "designing a K-shared network based on a set of one or more demands," as recited in the preamble of independent claims 16 and 32, is precisely the sort of "practical application" producing a "useful, concrete, and tangible result" deemed patentable by the

Federal Circuit. See, e.g., AT&T Corp. v. Excel Communications Inc., 172 F.3d 1352, 1359, 50 U.S.P.Q.2d 1447, 1452 (Fed. Cir. 1999) citing Arrhythmia Research Technology Inc. v. Corazonix Core, 958 F.2d 1053, 1060, 22 U.S.P.Q.2d 1033, 1039 (Fed. Cir. 1992) (finding "method claims satisfied §101 because the mathematical algorithm included within the process was applied to produce a number which had specific meaning--a useful, concrete, tangible result--not a mathematical abstraction."); State Street Bank & Trust Co. v. Signature Financial Group, 149 F.3d 1368, 1373, 47 U.S.P.Q.2d 1596, 1601 (Fed. Cir. 1998) citing Arrhythmia (upholding the patentable nature of "transformation of . . . signals . . . by a machine through a series of mathematical calculations constituted a practical application of an abstract idea (a mathematical algorithm, formula, or calculation), because it corresponded to a useful, concrete or tangible thing.").

First, with regard to the Examiner's argument in the final Office Action on page 4, lines 14-16, stating that "[t]he claims appear to be nothing more than a signal not tangibly embodied in a manner so as to be executable and thus non-statutory for failing to be in one of the categories of invention," Appellants disagree and submit that the Examiner's statement is a mischaracterization of the claims. Appellants duly note that a "signal" is not patentable subject matter as held by the Federal Circuit. See In re Nuijten, 500 F.3d 1346, 1348, 84 U.S.P.Q.2d 1495, 1496 (Fed. Cir. 2007). At the same time, Appellants are not claiming signals, rather, claims 16 and 32 recite a "method" and an "apparatus," respectively. Furthermore, even if the Examiner believes that the claims incorporate signals, the claims are still patentable because claims 16 and 32 fall within the patentable categories of a "method" and an "apparatus." As noted by the Federal Circuit, the PTO allowed Nuijten's method claims which comprised the step of encoding a signal. See In re Nuijten, 500 F.3d 1346, 1351, 84 U.S.P.Q.2d 1495, 1498 (Fed. Cir. 2007).

Next, for the sake of clarification, Appellants point out that the computed candidate primary paths and candidate secondary paths based on the set of one or more demands are manipulated based on the integer linear program formulation applied to the computed candidate primary paths and candidate secondary paths, and solving the integer linear program formulation so as to generate a K-shared network design - thus producing a "useful, concrete and tangible result."

In fact, the Examiner's statements in the final Office Action support the argument that the recited claims are statutory under §101. On page 4, lines 10-13, of the final Office Action, the

Examiner admits that the subject matter in question includes "both tangible embodiments and intangible embodiments." Thus, by this admission alone, claims 16 and 32 are statutory under §101. In addition, on page 5, lines 7-8 of the final Office Action, the Examiner states that "[a] process that consists solely of the manipulation of an abstract idea is not concrete or tangible" (emphasis added). Claims 16 and 32 are not solely based on intangible embodiments, rather the claims contain tangible embodiments, thus making the claims statutory under §101.

The final Office Action extensively cites In re Warmerdam, 33 F.3d 1354 (Fed. Cir. 1994). However, in the method claim at issue in Warmerdam, the recited steps of locating a medial axis of an object and creating a bubble hierarchy on the medial axis were found to involve "the solving of a mathematical algorithm" and to be "essentially mathematical in nature." See Warmerdam, at 1359-1360. The Federal Circuit further found that "the only practical . . . embodiment" involved utilization of a particular mathematical algorithm to locate the medial axis, followed by use of another mathematical algorithm to create the bubble hierarchy. See Warmerdam, at 1360. Accordingly, that method claim was found to recite nothing more than abstract ideas in the form of mathematical algorithms.

However, claims 16 and 32 as indicated above, recite computing candidate primary paths and candidate secondary paths based on a set of one or more demands . . . and solving an integer linear program formulation applied to the paths so as to generate a K-shared network design. Thus, while a part of the claims include solving an integer linear program formulation, the claims, when read in their entirety, are clearly not limited to a mathematical algorithm.

It is also important to view claims 16 and 32 in the light of State Street. In State Street, the Federal Circuit noted that the question of whether a claim encompasses statutory subject matter should focus on "the essential characteristics of the subject matter, in particular, its practical utility." See State Street, at 1375. The Federal Circuit further indicated that "the mere fact that a claimed invention involves inputting numbers, calculating numbers, outputting numbers, and storing numbers, in and of itself, would not render it non-statutory subject matter, unless . . . its operation does not produce a 'useful, concrete, and tangible result.'" See State Street, at 1374, citing In re Alappat, 33 F.3d 1526, 1544.

As previously stated, the claims generate a K-shared network based on a set of one or more

demands. Thus, the claims express a useful, concrete, and tangible result (K-shared network design) in the field of network design based on demands. Accordingly, the claims meet the requirements set forth in State Street, and do not preempt use of any particular mathematical algorithm(s) of the type at issue in Warmerdam. For at least these reasons, Appellants request withdrawal of the §101 rejection of claims 16 and 32.

*II. §112, first paragraph rejection of claims 16 and 32*

With regard to the §112, first paragraph rejection of claims 16 and 32, Appellants respectfully disagree with the allegation that the claimed invention is not supported by either a specific asserted utility or a well established utility. The above-noted arguments with regard to the §101 rejection of claims 16 and 32 clearly delineate producing a useful, concrete, and tangible result. Accordingly, the §112, first paragraph rejection of claims 16 and 32 should be withdrawn.

*III. Obviousness of claims 1-5, 11-15, 17-21, and 27-31*

*A. Independent claims 1 and 17*

Regarding the §103(a) rejection of independent claims 1 and 17, Appellants respectfully submit that the teachings of Gunluk and Chen, alone or in combination, fail to teach or suggest all of the limitations of the recited claims. Further, Appellants assert that the combination of the references is improper. It follows that the references fail to render the recited claims obvious as will be explained below. While Appellants may refer from time to time to each reference alone in describing its deficiencies, it is to be understood that such arguments are intended to point out the overall deficiency of the cited combination.

Appellants initially note that a proper case of obviousness has not been presented if the references, when combined, do not teach or suggest all the claim limitations. Furthermore, the claimed subject matter is not obvious if there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the references or to modify the reference teachings. An analysis supporting a rejection under 35 U.S.C. §103 should be explicit and should not based on mere conclusory statements. See KSR v. Teleflex, 127 S.Ct. 1727, 1741, 82 U.S.P.Q.2d 1385, 1396 (U.S., Apr. 30, 2007), quoting In re Kahn, 441 F.

3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.").

Independent claim 1 is directed to a method of determining a route for a demand in a network, wherein the network comprises primary paths and secondary paths, and at least two secondary paths may share a given link, the method comprising the steps of transforming a graph representing the network, wherein edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network, the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths; and finding the shortest path between nodes corresponding to the demand in the transformed graph, the shortest path representing the least-cost path in the network over which the demand may be routed. Claim 17 recites similar subject matter.

First, the Examiner argues that each and every one of the above-noted limitations is met by the collective teachings of Gunluk and Chen. Appellants disagree and submit that Gunluk and Chen do not teach or suggest what the Examiner contends that they teach or suggest. Appellants initially note that in presenting the §103(a) argument, the Examiner references Gunluk at FIG. 2 and reprints verbatim, text from Gunluk, column 8, lines 34-50; column 9, lines 8-13; and column 9, lines 18-25. The Examiner also cites Chen, FIG. 6; column 2, lines 31 "plus"; and column 7, lines 42 "plus." Final Office Action, page 9, last paragraph, to page 10, line 4. Appellants submit that the Examiner fails to clearly explain how Gunluk and Chen teach the limitations of the recited claims and respectfully contend that the final Office Action, like the Action before it, fails to comply with 35 U.S.C. 132(a) ("Whenever, on examination, any claim for a patent is rejected, or any objection or requirement made, the Director shall notify the applicant thereof, stating the reasons for such rejection, or objection or requirement, together with such information and references as may be useful in judging of the propriety of continuing the prosecution of his application."); 37 CFR 1.104(c)(2) ("In rejecting claims for want of novelty or for obviousness, the examiner must cite the best references at his or her command. When a reference is complex or shows or describes inventions other than that claimed by the applicant, the particular part relied on must be designated as nearly as practicable. The pertinence of each reference, if not apparent, must be clearly explained and each rejected claim specified."); and MPEP 706.02(j) ("Where a reference is relied on to support

a rejection, whether or not in a minor capacity, that reference should be positively included in the statement of the rejection. See In re Hoch, 428 F.2d 1341, 1342 n.3, 166 U.S.P.Q. 406, 407 n.3 (CCPA 1970). It is important for an examiner to properly communicate the basis for a rejection so that the issues can be identified early and the applicant can be given fair opportunity to reply."). Nonetheless, Appellants traverse the Examiner's generalized rejection.

Gunluk does not teach the step of transforming a graph representing the network, wherein edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network, the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths. FIG. 2 of Gunluk is a flow chart of a method 200 for routing demands. Demands T are individually routed, such that if a demand $T_j$ has already been routed on route $R_j$ and is required to be diverse from $T_i$, demand $T_i$ is then routed on route $R_i$ using a shortest path algorithm. Assuming that Gunluk's constructed representation of the network teaches or suggests the recited graph representing the network of claim 1, Gunluk does not disclose transforming the constructed representation of the network such that costs associated with the edges of the representation reflect costs of using channels in secondary paths. No where does Gunluk distinguish between primary paths and secondary paths as recited in the claims. For example, Gunluk discloses routes $R_j$ and $R_i$ corresponding to demands $T_j$ and $T_i$, respectively; however, routes $R_j$ and $R_i$ appear to be undistinguished primary paths, not secondary paths of a network (e.g., backup paths of a K-shared network). Primary paths and secondary paths are described in the specification at, for example, page 5, lines 11-13, "[i]n the traditional path restoration techniques, each demand has a dedicated primary path and a precomputed backup (secondary) path, and the backup paths of multiple demands may have common channels." For at least these reasons, Gunluk does not teach transforming a graph representing the network, wherein edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network, the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths.

It follows that Gunluk fails to teach the step of finding the shortest path between nodes corresponding to the demand in the transformed graph, the shortest path representing the least-cost path in the network over which the demand may be routed. Gunluk does disclose a specialized

shortest path algorithm (Gunluk, col. 9, lines 8-13.); however, this does not teach the recited step because Gunluk does not disclose the transformed graph as recited in claim 1. As discussed above, Gunluk is not transforming a graph representing a network, comprising primary paths and secondary paths, the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths. Therefore, even if Gunluk's use of a specialized shortest path algorithm to "find the shortest path for each demand $T_i$ that will increase the overall cost least" is equivalent to finding the least-cost path in a network, Gunluk still fails to teach the recited step of finding the shortest path between nodes corresponding to the demand in the transformed graph.

The Chen reference fails to supplement the above-noted deficiencies of Gunluk as applied to claim 1. Chen discloses automatic provisioning of end-to-end paths for SONET networks. Chen, col. 2, Summary of the Invention. However, Appellants contend that Chen does not determine a route for a demand in a network as recited in claim 1. Like Gunluk, Chen does not transform a graph representing a network and find the shortest path between nodes corresponding to the demand in the transformed graph. Accordingly, it is believed that the combined teachings of Gunluk and Chen fail to meet the limitations of claim l. Gunluk and Chen also fail to teach the limitations of claim 17, which recites subject matter similar to claim 1.

Next, the Examiner has failed to identify a cogent motivation for combining Gunluk and Chen in the manner proposed. The Examiner provides the following statement of motivation at page 11, first full paragraph of the final Office Action:

> One skilled in the art of communications would recognize the need for determining a route for a demand in a network routing, and would apply Chen's novel use of the automatic end to end paths for SONET networks into Gunluk's method of routing signals over an optical network while satisfying diversity requirements and other network constraints. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention was made to apply Chen's systems and methods for automatic end to end path provisioning for SONET networks into Gunluk's method for routing optical signals with diversity requirements with the motivation being to provide a system and method for routing and design in K-shared network.

Appellants respectfully submit that this is a conclusory statement of the sort rejected by both the Federal Circuit and the U.S. Supreme Court. See KSR v. Teleflex, No. 13-1450, slip. op. at 14

(U.S., Apr. 30, 2007), quoting In re Kahn, 441 F. 3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness."). There has been no showing in the present §103(a) rejection of objective evidence of record that would motivate one skilled in the art to combine Gunluk and Chen to produce the particular limitations in question. At the very least, the Examiner should have clearly explained how the references teach the steps of the recited independent claims; Appellants believe that this has not been done.

For at least these reasons, Appellants believe that independent claims 1 and 17 are patentable over Gunluk and Chen. Accordingly, Appellants respectfully request withdrawal of the §103(a) rejection of claims 1 and 17.

*B. Dependent claims 2-5, 15, 18-21, and 31*

Regarding the §103(a) rejection of dependent claims 2-5, 15, 18-21, and 31, Appellants respectfully assert that such claims are patentable not only due to their respective dependence on claims 1 and 17, but also because such claims recite patentable subject matter in their own right.

As with independent claims 1 and 17, Appellants note that the Examiner has not clearly explained how the combined references teach each and every limitation of dependent claims 2-5, 15, 18-21, and 31. An examiner, in rejecting dependent claims, must provide a detailed explanation of his or her reasoning in rejecting each and every claim, and not merely combine the dependent claims together with the independent claims for purposes of pointing with specificity the portions of the prior art reference relied upon. Nonetheless, Appellants contend that both Gunluk and Chen fail to teach the recited claims.

For example, claims 2 and 18 recite that the graph transformation step further comprises transforming channels into nodes of the graph. Neither Gunluk nor Chen discloses transforming channels into nodes of a graph as recited in the claims. Dependent claims 3 and 19 specifically recite that a path comprises one or more links and a link $l$ between two nodes $u$ and $v$ is represented as $(u, v)$ and a channel in the link is represented as $l^i$ such that the step of transforming channels into nodes further comprises creating two nodes $u(l, i)$ and $v(l, i)$ and an edge between them. Further, claims 4

and 20 recite that the cost of the created edge is a function of the channel. One illustrative embodiment of transforming channels into nodes is described in the specification at, for example, page 7, lines 25-27: "Transform channels into nodes (step 252): Consider any link $l = (u, v)$ and channel $l^i$ in it. Create two nodes $u(l, i)$ and $v(l, i)$ and an edge between them. The cost of this edge is the cost $c(l_i)$ as stated above." The combined references do not teach the subject matter as recited in the claims and supported in the specification.

Further, the cited references do not teach that the graph transformation step further comprises representing channel connectivity (claims 5 and 21). One illustrative embodiment of representing channel connectivity is described in the specification at, for example, page 7, line 28, to page 8, line 2: "Capture channel connectivity (step 254): Consider any pair of channels $l^i$ and $m^j$ incident on a node $u$. If these channels are already connected at $u$, then add a zero-cost edge between $u(l, i)$ and $u(m, j)$. Otherwise, if both channels have degrees less than $K$ at $u$, then connect them with an edge costing $\in$ $(0 < \in << 1)$. This cost is to prefer existing connections over new ones, because a new connection would increase the degree of the channel." Also, the cited references do not teach that the transforming and finding steps are used to compute one or more paths for optical burst switching (claims 15 and 31). Optical burst switching is not disclosed in either Gunluk or Chen.

For at least these reasons, Appellants believe that dependent claims 2-5, 15, 18-21, and 31, are not obvious in light of the combined references, Gunluk and Chen. Accordingly, Appellants respectfully request withdrawal of the §103(a) rejection of dependent claims 2-5, 15, 18-21, and 31.

*C. Dependent claims 11-14 and 27-30*

Regarding the §103(a) rejection of dependent claims 11-14 and 27-30, Appellants respectfully assert that such claims are patentable not only due to their respective dependence on claims 1 and 17, but also because such claims recite patentable subject matter in their own right.

The Examiner argues that Chen teaches the recited dependent claims at Chen, FIG .8; column 9, lines 10-38; and column 2, lines 40 "plus." Final Office Action, page 10, first full paragraph, to page 11, line 2. Appellants disagree. FIG. 8 of Chen is a flow chart illustrating an automatic path provisioning process performed by a network management system. No where in the Chen reference does Chen disclose executing an alternative routing process so as to determine a loopless path for the

demand, when the route determination steps result in a path with at least one loop (claims 11 and 27). An illustrative embodiment of the alternative routing process is described in the specification at, for example, page 9, lines 1-13, with reference to FIG. 5A.

It follows that Chen fails to teach the subject matter of claims 12-14 and 28-30, which also recite matter regarding the alternative routing process. Claims 12 and 28 recite that the alternative routing process further comprises finding *r* shortest paths between the source node and the destination node associated with the demand in the graph. See, e.g., Specification, page 9, lines 3-10. Claims 13 and 29 recite that the alternative routing process further comprises, for each of the *r* shortest paths, computing a corresponding least-cost loopless path. See, e.g., Specification, page 9, lines 11-12, and page 9, lines 14-25, with reference to FIG. 5B. Further, claims 14 and 30 recite that the alternative routing process further comprises selecting the least-cost path among the *r* paths as a secondary path for the demand. See, e.g., Specification, page 9, lines 12-13. Chen fails to disclose an alternative routing process as detailed in the recited dependent claims.

For at least these reasons, Appellants believe that dependent claims 11-14 and 27-30, are not obvious in light of the combined references, Gunluk and Chen. Accordingly, Appellants respectfully request withdrawal of the §103(a) rejection of dependent claims 11-14 and 27-30.

For the reasons stated above, Appellants respectfully request withdrawal of the §101, §112, first paragraph, and §103(a) rejections. The present application is believed to be in condition for allowance, and such favorable action is respectfully solicited.

Respectfully submitted,

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## CLAIMS APPENDIX

1. A method of determining a route for a demand in a network, wherein the network comprises primary paths and secondary paths, and at least two secondary paths may share a given link, the method comprising the steps of:

transforming a graph representing the network, wherein edges of the graph represent channels associated with paths and nodes of the graph represent nodes of the network, the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths; and

finding the shortest path between nodes corresponding to the demand in the transformed graph, the shortest path representing the least-cost path in the network over which the demand may be routed.

2. The method of claim 1, wherein the graph transformation step further comprises the step of transforming channels into nodes of the graph.

3. The method of claim 2, wherein a path comprises one or more links and a link $l$ between two nodes $u$ and $v$ is represented as $(u, v)$ and a channel in the link is represented as $l^i$ such that the step of transforming channels into nodes further comprises creating two nodes $u(l, i)$ and $v(l, i)$ and an edge between them.

4. The method of claim 3, wherein the cost of the created edge is a function of the channel.

5. The method of claim 4, wherein the graph transformation step further comprises the step of representing channel connectivity.

11. The method of claim 1, wherein when the route determination steps result in a path with at least one loop, executing an alternative routing process so as to determine a loopless path for the demand.

12. The method of claim 11, wherein the alternative routing process further comprises the step of finding $r$ shortest paths between the source node and the destination node associated with the demand in the graph.

13. The method of claim 12, wherein the alternative routing process further comprises the step of, for each of the $r$ shortest paths, computing a corresponding least-cost loopless path.

14. The method of claim 13, wherein the alternative routing process further comprises the step of selecting the least-cost path among the $r$ paths as a secondary path for the demand.

15. The method of claim 1, wherein the transforming and finding steps are used to compute one or more paths for optical burst switching.

16. A method of designing a K-shared network based on a set of one or more demands, comprising the steps of:

computing candidate primary paths and candidate secondary paths based on the set of one or more demands, wherein at least two candidate secondary paths may share a given channel and the number of shared channels incident on another channel is a finite number K;

applying an integer linear program formulation to the computed candidate primary paths and candidate secondary paths; and

solving the integer linear program formulation applied to the computed candidate primary paths and candidate secondary paths so as to generate a K-shared network design.

17. Apparatus for determining a route for a demand in a network, wherein the network comprises primary paths and secondary paths, and at least two secondary paths may share a given link, the apparatus comprising:

a memory; and

at least one processor coupled to the memory and operative to: (i) transform a graph representing the network, wherein edges of the graph represent channels associated with paths and

nodes of the graph represent nodes of the network, the transformation being performed such that costs associated with the edges reflect costs of using channels in secondary paths; and (ii) find the shortest path between nodes corresponding to the demand in the transformed graph, the shortest path representing the least-cost path in the network over which the demand may be routed.

18. The apparatus of claim 17, wherein the graph transformation operation further comprises transforming channels into nodes of the graph.

19. The apparatus of claim 18, wherein a path comprises one or more links and a link $l$ between two nodes $u$ and $v$ is represented as $(u, v)$ and a channel in the link is represented as $l^i$ such that the step of transforming channels into nodes further comprises creating two nodes $u(l, i)$ and $v(l, i)$ and an edge between them.

20. The apparatus of claim 19, wherein the cost of the created edge is a function of the channel.

21. The apparatus of claim 20, wherein the graph transformation operation further comprises representing channel connectivity.

27. The apparatus of claim 17, wherein when the route determination operations result in a path with at least one loop, executing an alternative routing process so as to determine a loopless path for the demand.

28. The apparatus of claim 27, wherein the alternative routing process further comprises finding $r$ shortest paths between the source node and the destination node associated with the demand in the graph.

29. The apparatus of claim 28, wherein the alternative routing process further comprises, for each of the $r$ shortest paths, computing a corresponding least-cost loopless path.

30. The apparatus of claim 29, wherein the alternative routing process further comprises selecting the least-cost path among the *r* paths as a secondary path for the demand.

31. The apparatus of claim 17, wherein the transforming and finding operations are used to compute one or more paths for optical burst switching.

32. Apparatus for designing a K-shared network based on a set of one or more demands, the apparatus comprising:

a memory; and

at least one processor coupled to the memory and operative to: (i) compute candidate primary paths and candidate secondary paths based on the set of one or more demands, wherein at least two candidate secondary paths may share a given channel and the number of shared channels incident on another channel is a finite number K; (ii) apply an integer linear program formulation to the computed candidate primary paths and candidate secondary paths; and (iii) solve the integer linear program formulation applied to the computed candidate primary paths and candidate secondary paths so as to generate a K-shared network design.

EVIDENCE APPENDIX

None.

## RELATED PROCEEDINGS APPENDIX

None.